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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/718,385	11/19/2003	John K. Grady		9722

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EXAMINER	
POLYZOS, FAYE S	

ART UNIT	PAPER NUMBER
2884	

DATE MAILED: 12/13/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/718,385	GRADY, JOHN K.	
	Examiner	Art Unit	
	Faye Polyzos	2884	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 November 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *10-16* is/are allowed.

6)☒ Claim(s) *1-4 and 6-9* is/are rejected.

7)☒ Claim(s) *5* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 November 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *3/2/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1 and 7 are rejected under 35 U.S.C. 102(e) as being anticipated by *Ebstein et al (US 6,180,946 B1).*

Regarding claim 1, Ebstein discloses an x-ray detector for fluoroscopy comprising: a screen (204) configured to convert x-rays into photons; an array of image sensors (206) positioned behind the screen and having at least one output for connection to a computer or other electronic imaging processor, each of the image sensors comprising a plurality of photosensor pixels; and a demagnification lens system (203) positioned between the screen and the array of image sensors and configured to transfer photons emitted by the screen to the array of image sensors (col. 2, lines 1-20), the lens system comprising an array of individual lenses (See Fig. 2); wherein the lens system is quantum limited in operation and able to transfer very low levels of photons from the screen to each photosensor pixel; and each image sensor is configured to detect very low levels of photons (See Generally Fig. 2 and col. 3, lines 54-67, col. 4, lines 1-11 and lines 65-67, col. 5, lines 1-10 and col. 6, lines 57-63).

Regarding claim 7, Ebstein discloses the lens system has an optimized demagnification ratio for providing quantum-limited operation (col. 4, lines 66-67 and col. 5, lines 1-10).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 2-4, 6 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Ebstein et al (US 6,180,946 B1)* as applied to claim 1 above, and further in view of *Lee et al (US 6,437,339 B2).*

Regarding claim 2, Ebstein discloses an x-ray detector for fluoroscopy comprising: a screen (204) configured to convert x-rays into photons; an array of image sensors (206) positioned behind the screen and having at least one output for connection to a computer or other electronic imaging processor, each of the image sensors comprising a plurality of photosensor pixels; and a demagnification lens system (203) positioned between the screen and the array of image sensors and configured to transfer photons emitted by the screen to the array of image sensors (col. 2, lines 1-20), the lens system comprising an array of individual lenses (See Fig. 2); wherein the lens system is quantum limited in operation and able to transfer very low levels of photons from the screen to each photosensor pixel; and each image sensor is configured to detect very low levels of photons (See Generally Fig. 2 and col. 3, lines 54-67, col. 4,

lines 1-11 and lines 65-67, col. 5, lines 1-10 and col. 6, lines 57-63). Ebstein does not disclose of a controlled avalanche charge multiplication process. Lee discloses of a flat panel x-ray imager comprising an on-board gain mechanism in the form of an extended section of gain register, the extended section of gain register comprising a plurality of stages controllably clocked to produce a slight and well-controlled avalanche charge multiplication process and, thereby, a slight gain per stage (col. 1, lines 35-42, col. 2, lines 3-10, col. 3, lines 62-67, col. 4, lines 57-66). Lee teaches the flat panel device can be enhanced to improve its ability to image at low x-ray exposure through enhancing the charge signal produced from the incoming x-ray and therefore increasing the sensitivity of image formation and producing a radiation image from a very low level of radiation. This can be done through the use of a gain or charge multiplication layer in addition to known layers of a flat panel detector (col. 2, lines 3-10). Therefore, it would have been obvious to modify the apparatus disclosed by Ebstein, to include an avalanche charge multiplication process, as disclosed supra by Lee, to allow for a more versatile apparatus.

Regarding claims 3 and 4, Lee discloses of an x-ray detector for fluoroscopy wherein the photosensor pixels of each image sensor are non-avalanche multiplication photodiodes (col. 1, lines 57-67 and col. 2, lines 1-10).

Regarding claim 6, Ebstein discloses the image sensors can be CCD image sensors; the photosensor pixels are non-avalanche multiplication photodiodes (See Generally Fig. 2 and col. 3, lines 54-67, col. 4, lines 1-11 and lines 65-67, col. 5, lines 1-10 and col. 6, lines 57-63). Ebstein does not specifically disclose of a CCD gain

section. Lee discloses a CCD gain section acts as a charge amplifier for boosting signal levels and reducing noise (col. 1, lines 57-67, col. 2, lines 1-10, col. 4, lines 57-67 and col. 5, lines 1-15). Lee teaches x-ray absorbing anywhere within the thickness of the photoconductor create changes that drift to the amplifier region. They are then accelerated across a constant thickness of the layer resulting in a constant charge multiplication. Lee also teaches the x-ray detection lower limit of such a device depends to a large extent on the charge signal generated from the incoming x-rays and the level of electronic noise in the readout circuit (col. 1, lines 66-67 and col. 2, lines 1-2). Therefore, it would have been obvious to modify the apparatus suggested by Ebstein to include a CCD gain section, as disclosed supra by Lee, to allow for a more versatile apparatus.

Regarding claim 8, although Ebstein does not disclose the number of individual lenses selected from the group consisting of: four lenses in a 2x2 array; nine lenses in a 3x3 array, and sixteen lenses in a 4x4 array, it is well known for x-ray detectors to comprise an equal number of individual lenses and image sensors (See Generally Fig. 2) and wherein the number of individual lenses are well known to be in an array of 2x2 or 3x3 or 4x4 array.

5. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over *Ebstein et al (US 6,180,946 B1)* as applied to claim 1 above, and further in view of *Stanton et al (US 6,48,544 B1).*

Regarding claim 9, Ebstein discloses an x-ray detector for fluoroscopy comprising: a screen (204) configured to convert x-rays into photons; an array of image

sensors (206) positioned behind the screen and having at least one output for connection to a computer or other electronic imaging processor, each of the image sensors comprising a plurality of photosensor pixels; and a demagnification lens system (203) positioned between the screen and the array of image sensors and configured to transfer photons emitted by the screen to the array of image sensors (col. 2, lines 1-20), the lens system comprising an array of individual lenses (See Fig. 2); wherein the lens system is quantum limited in operation and able to transfer very low levels of photons from the screen to each photosensor pixel; and each image sensor is configured to detect very low levels of photons (See Generally Fig. 2 and col. 3, lines 54-67, col. 4, lines 1-11 and lines 65-67, col. 5, lines 1-10 and col. 6, lines 57-63). Ebstein does not disclose of enclosing image sensors or cooling by heat removal system. Stanton disclose of a x-ray detector wherein the array of image sensors is enclosed in a thermally-insulated, gas-sealed enclosure that is cooled by a heat removal system (col. 5, lines 49-67 and col. 6, lines 1-59). Stanton teaches to reduce noise and provide the improved dynamic range and spatial resolution for early can detection, each CCD detector is thermally coupled and cooled by a cooling module. The cooling manifold provides the necessary heat transfer to properly cool a thermoelectric cooling device of cooling module (col. 13, lines 1-7). Therefore, it would have been obvious to modify the apparatus suggest by Ebstein to include a cooled thermally insulated enclosure of the image sensors, as disclosed supra by Stanton, to allow for a more versatile apparatus.

Allowable Subject Matter

6. Claims 10-16 are allowed.

The following is a statement of reasons for the indication of allowable subject matter:

Regarding independent claim 10, the prior art does not disclose or fairly suggest a quantum-limited x-ray detector for fluoroscopy comprising: a lens system in operation for transferring from the screen to the array of image sensors at least ten photons per photodetector pixel per frame for 30 frames-per-second fluoroscopy.

The examiner notes that while it is known in the art of an x-ray detector for fluoroscopy comprising: a screen (204) configured to convert x-rays into photons; an array of image sensors (206) positioned behind the screen and having at least one output for connection to a computer or other electronic imaging processor, each of the image sensors comprising a plurality of photosensor pixels; and a demagnification lens system (203) positioned between the screen and the array of image sensors and configured to transfer photons emitted by the screen to the array of image sensors (col. 2, lines 1-20), the lens system comprising an array of individual lenses (See Fig. 2); wherein the lens system is quantum limited in operation and able to transfer very low levels of photons from the screen to each photosensor pixel; and each image sensor is configured to detect very low levels of photons (see for example Ebstein et al – US 6,180,946 B1 –Fig. 2 and col. 3, lines 54-67, col. 4, lines 1-11 and lines 65-67, col. 5, lines 1-10 and col. 6, lines 57-63) and a CCD gain section acts as a charge amplifier for boosting signal levels and reducing noise (see for example *Lee et al -- US 6,437,339 B2* -- col. 1, lines 57-67, col. 2, lines 1-10, col. 4, lines 57-67 and col. 5, lines 1-15), the prior art does not fairly suggest of the transfer of photons from the screen to the array of

image sensors being at least ten photons per photosensor pixel per frame for 30 frames-per-second fluoroscopy.

Regarding independent claim 14, the prior art does not disclose or fairly suggest a quantum-limited x-ray detector for fluoroscopy comprising: an optimized demagnification ratio for quantum-limited operation configured to provide to the image sensor pixels a minimum light signal of at least one photon per x-ray conversion in the screen per frame for 30 frames-per-second fluoroscopy.

The examiner notes that while it is known in the art of an x-ray detector for fluoroscopy comprising: a screen (204) configured to convert x-rays into photons; an array of image sensors (206) positioned behind the screen and having at least one output for connection to a computer or other electronic imaging processor, each of the image sensors comprising a plurality of photosensor pixels; and a demagnification lens system (203) positioned between the screen and the array of image sensors and configured to transfer photons emitted by the screen to the array of image sensors (col. 2, lines 1-20), the lens system comprising an array of individual lenses (See Fig. 2); wherein the lens system is quantum limited in operation and able to transfer very low levels of photons from the screen to each photosensor pixel; and each image sensor is configured to detect very low levels of photons (see for example Ebstein et al – US 6,180,946 B1 –Fig. 2 and col. 3, lines 54-67, col. 4, lines 1-11 and lines 65-67, col. 5, lines 1-10 and col. 6, lines 57-63) and a CCD gain section acts as a charge amplifier for boosting signal levels and reducing noise (see for example *Lee et al -- US 6,437,339 B2* -- col. 1, lines 57-67, col. 2, lines 1-10, col. 4, lines 57-67 and col. 5, lines 1-15), the

prior art does not fairly suggest of the transfer of photons from the screen to the array of image sensors being at least ten photons per photosensor pixel per frame for 30 frames-per-second fluoroscopy.

The remaining claims 11-13 and 15-16 are allowable based on their dependency.

7. Claim 5 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Regarding dependent claim 5, the prior art, as stated supra, does not disclose or fairly suggest of an x-ray detector for fluoroscopy wherein the lens system is configured to transfer from the screen to the array of image sensors at least ten photons per photosensor pixel per frame at 30 frames-per-second fluoroscopy.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Faye Polyzos whose telephone number is 571-272-2447. The examiner can normally be reached on Monday thru Friday from 7:30 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dave Porta can be reached on 571-272-2444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

10. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

FP

OTILIA GABOR
PRIMARY EXAMINER